iPRENA-V

Precision Inertial/GNSS/VMS based Navigation System

iPRENA-V is part of an INS product family for inertial navigation, gyro compasssing, surveying and dynamic motion measurement with ring laser gyros (RLG), that covers applications, which require highest accuracy, reliability and easy usage.

- High performance inertial navigation and surveying system for defence, airborne, naval, underwater, surface and railway applications
- True North Reference, gyro compassing
- Azimuth, elevation, position ad more
- Various Interfaces: UART RS422, CAN, Ethernet TCP/IP & UDP;
  options: ARINC429, ARINC825, HDLC or customized
- Integrated L1L2 GNSS, SAASM capability as option
- High bandwidth, fast response, low latency
- Option: integrated time sync. and 2 cm accurate GPS/GLONASS/GALILEO / RTK
- RLG technology with very low gyro drift and long time performance
- COTS item, dual-use; MIL qualified

iPRENA-V consists of three high precision ring laser gyroscopes, three servo accelerometers, a powerful strapdown processor and an universal interface.

The system contains an internal RTK capable GNSS receiver and can also be operated with external GNSS receivers. Available output interfaces are Ethernet (TCP/IP, UDP), RS232/422 UART, CAN, ARINC429, ARINC825, CANaero, HDLC as well as internal data storage on solid-state non-volatile memory (“black-box”). Application specific interfaces can be provided on request.

Data processing (strapdown algorithms, global or local navigation, gyro compassing, AHRS support, INS/GNSS/VMS data fusion with supported periodical ZUPT and way-point aiding etc.) is performed inside of the iPRENA-V.

The iPRENA supports “plug & play” operation incl. automatic estimation of the wheel sensors scale factor and misalignment. It operates a tightly or loosely coupled INS/GNSS/VMS based data fusion, using

iMAR’s highly sophisticated 42+ state extended Kalman filtering. The user software iXCOM-CMD incl. moving map (under Linux and MS Windows) supports operation, visualization and maintenance (also remote via network).

iPRENA-V is covered by European and US-American export control regulations.

The system is available in three classes of performance:
- MP Medium Precision
- HP High Precision
- UP Ultra Precision

Due to the modular system architecture, the iPRENA-V can be delivered with customized data interfaces, e.g. to operate as fit & function replacement for e.g. obsolete navigation systems of other providers. **As an ITAR-free alternative**, the systems **iPRENA-II/III/IV** are provided.




Technical Data of iPRENA-V-MP/-HP/-UP (rms values)

Performance:	True Heading:	MP: < 0.50- (0.028°) sec(lat) free inertial; 0.008° with GNSS
		HP: < 0.35- (0.020°) sec(lat) free inertial; 0.008° with GNSS
		UP: < 0.26- (0.015°) sec(lat) free inertial; 0.008° with GNSS
	Attitude Accuracy:	MP: < 0.35- (0.020°) free inertial RMS (< 0.005° with GNSS)
		HP: < 0.26- (0.015°) free inertial RMS (< 0.005° with GNSS)
		UP: < 0.18- (0.010°) free inertial RMS (< 0.005° with GNSS)
	Position accuracy:	< 2 m [CEP] (under sufficient GNSS visibility, S/A off)
		< 0.1 m [CEP] RTK-GNSS (option)
		< 0.1 % DT [CEP] during GNSS outages, with VMS
		< 0.2 nm/hr (-UP), < 0.5 nm/hr (-HP), < 0.8 nm/hr (-MP) free inertial[1]
	Velocity accuracy:	< 1 cm/s (GNSS aided); < 1 m/s free inertial[1]
	Altitude:	< 5 m [rms] (under sufficient GNSS conditions, with VMS)
		< 0.1 % DT [rms] during GNSS outages, with VMS

Heading Drift (unaided): < 0.06 -/hr (0.003 °/hr) [bounded by gyro compassing]

					Land Vehicle Alignment Duration:					
ARW / Q and bias:	Gyroscopes		Accelerometer		0.25°	0.1°	0.05°	0.025°	0.015°	
iiPRENA-V-UP:	< 0.0011 °/√h	0.002 °/hr	< 8 µg/√Hz	25 µg |	2 min	2 min	3 min	6 min	22 min	@ lat 0°
					2 min	3 min	5 min	20 min		@ lat 50°
iPRENA-V-HP:	< 0.0015 °/√h	0.003 °/hr	< 10 µg/√Hz	25 µg |	2 min	2 min	4 min	12 min		@ lat 0°
					2 min	3 min	7 min	120 min		@ lat 50°
iPRENA-V-MP:	< 0.0020 °/√h	0.003 °/hr	< 12 µg/√Hz	50 µg |	2 min	3 min	5 min			@ lat 0°
					2 min	4 min	10 min			@ lat 50°
all devices:					1 min	<2 min	< 3 min	<4 min	under motion+GNSS[2]	

Sensor Range:	Angular Rate: ± 400 °/s (no angle limitation) | Acceleration: ±20 g
Angular Resolution:	1.13 arcsec (< 0.000'31 °)
Output Interfaces:	RS232/422 UART, Ethernet TCP/IP / UDP, CAN, ARINC429, ARINC825, PPS / SYNC (RS422 level); HDLC/SDLC and NTP/PTP on Ethernet as option
Data Output Rate:	interger divisor of 300 Hz, internal data rate 1'800 Hz, bandwidth 300 Hz
Input Interfaces:	external GNSS receiver (option, e.g. ERGR); event marker / GPIO (opto-coupler), SYNC, VMS / odometer / wheel sensor (A/B, opto-coupler input up to 32 V, also operable with RS422 level)
GNSS Receiver:	internal GNSS receiver (L1 or L1L2, GPS / GLONASS / Beidou, SBAS; SAASM etc.); dual-antenna setup as option
Connectors:	MIL-C-38999 Series III, TNC for GNSS antenna; earthing screw
Temperature, humid.:	-46 to +71°C operating (case), -55 to +85°C not operating; 8...100% rel. Humidity; IP67
Magnetic insensitivity:	< 500 µTesla (5 Gauss)
MTBF / MTTR:	> 25,000 hrs (estimated for surveying applications) / < 30 minutes
Shock, Vibration:	20 g, 11 ms operational; 40 g, 6 ms (endurance); 20…2'000 Hz, 6.3 g rms
Qualification:	MIL-STD-810G, MIL-STD-461G, MIL-STD-704F, partially DO160G
Power:	10...34 V DC, < 25 W (incl. GNSS); 50 ms hold up time according to DO160 Continuous overvoltage protection up to 60 V
Weight / Size:	approx. 7.9 kg / approx. 187 x 128 x 296 mm³ (WxHxL; without connectors)
Software:	iXCOM & NMEA183 commun. protocol, iXCOM-CMD GUI; iXCOM-CMD supports easy system configuration and moving map (Linux and Windows)
Data storage:	up to 32 GByte on internal non-volatile memory on board (as data logger, "black-box")
Alignment Methods:	Static Alignment, Dynamic Alignment, Stored & Forced Heading/Position Alignment
Aiding Methods:	GNSS aided, VMS aided, ZUPT aided, Waypoint aided

iMAR uses latest and high reliable ring laser gyro technology inside the iPRENA-V advanced inertial navigation and guidance systems for industrial and defence applications.

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[1] Can be improved if sufficient GNSS aiding and motion is available before switching to free inertial mode
[2] with sufficient GNSS observations and sufficient trajectory (i.e. with several significant heading changes under motion)